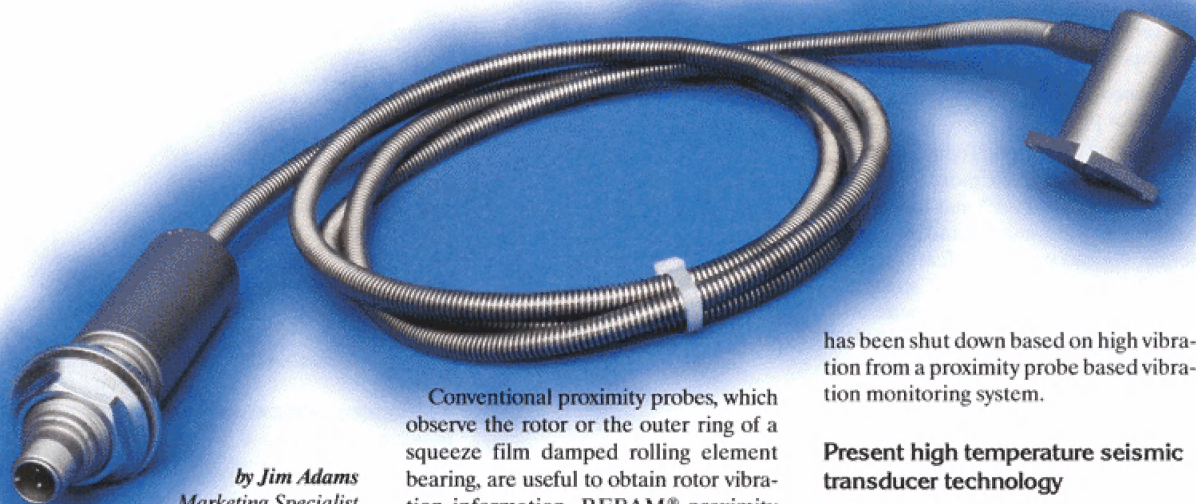


# The High Temperature Velomitor®

*A new approach to high temperature seismic vibration*



*by Jim Adams  
Marketing Specialist  
Bently Nevada Corporation*

**V**ibration monitoring is widely used to increase the availability of gas turbines. It can often detect internal damage, so the turbine can be shut down and repaired before the damage progresses to a catastrophic stage. Proximity probe methodology is usually the best way to measure rotor-related machine vibration because it is a direct measurement of the motion of the rotor or the flexing of the outer ring of a roller element bearing. Gas turbines can have either fluid film or rolling element bearings, depending on their design. Application of proximity probes to gas turbines with fluid film bearings is similar to that in steam turbines and process compressors with fluid film bearings, although some special consideration of temperature is required.

Conventional proximity probes, which observe the rotor or the outer ring of a squeeze film damped rolling element bearing, are useful to obtain rotor vibration information. REBAM® proximity probes observing the outer ring of rigidly-mounted rolling element bearings are useful to obtain bearing condition and rotor vibration information.

Seismic casing vibration monitoring is sometimes used to supplement proximity probe vibration-based monitoring on gas turbines. In some circumstances, only seismic casing vibration is monitored on gas turbines. This is often due to economic or transducer installation considerations. A gas turbine vibration monitoring system with seismic pickups is generally less effective than one that uses proximity probes. Machinery problems can be detected earlier when machinery is monitored with proximity probes measuring shaft motion and position directly. Typically, a turbine that has been shut down based solely on high seismic vibration will have more extensive internal damage than one that

has been shut down based on high vibration from a proximity probe based vibration monitoring system.

## **Present high temperature seismic transducer technology**

### **Velocity pickups**

High temperature moving coil velocity transducers were once widely-used for casing seismic, rotor-related vibration monitoring of gas turbines. They have been replaced by high temperature accelerometers on many large gas turbines and on some small gas turbines. Because high temperature velocity transducers have moving parts, they have limited life spans and are susceptible to accelerated degradation due to cross axis vibration which is often present on gas turbines.

As velocity transducers degrade, the likelihood of false and missed trips increases. False trips often cause major business disruptions. Missed trips can result in greater machinery damage and associated costs than if the vibration monitor had detected an unacceptable increase in vibration and the machine had been shut down.

# System (HTVS)

## *monitoring of gas turbines.*

One approach to the problem of velocity transducer degradation is to replace the transducers on a periodic basis. This involves additional cost, both in material and labor. It also increases the required machinery downtime to physically replace the transducer.

### **Accelerometers**

High temperature piezoelectric accelerometers, since they have no moving parts, overcome the problems inherent in transducers with moving parts. Unfortunately, they often have their own limitations. Their output is a low-level, high impedance signal that is extremely susceptible to the slightest connection problem, especially in a high vibration environment. The acceleration levels of the rotor vibration components are usually a small percentage of the overall acceleration signal due to the presence of high acceleration levels at higher frequencies. Integration of the acceleration signal to velocity reduces the relative amplitude of the high frequency - high acceleration level signals. However, high integration gains at low frequencies make the system with integration even more susceptible to connection problems. Some piezoelectric accelerometer-based systems have overcome these problems, but they are normally much more expensive than a high temperature velocity pickup.

### **High Temperature Velomitor®**

The High Temperature Velomitor® System, without using moving parts, provides a velocity output similar to that of a high temperature velocity pickup. It

also solves many problems inherent in piezoelectric alternatives, and its price is comparable to that of a high temperature velocity pickup.

### **Differences between the High Temperature and the standard Velomitor®**

The standard Bently Nevada Velomitor® has electronics located in the same case as the piezoelectric sensing element. Temperature limitations of the electronics limit the maximum operating temperature to 121°C (250°F).

The High Temperature Velomitor® has a high temperature piezoelectric sensing element. The piezoelectric sensing element and the electronics are in two separate cases, permanently connected by a sealed flexible tube. The whole assembly is then hermetically-sealed. This allows the electronics to be located in an area where the temperature is much lower than it is on the casing of a gas turbine without having connectors between the sensing unit and the electronics. Connectors between the piezoelectric sensing unit and the electronics have been a major source of nuisance alarms on gas turbines with piezoelectric accelerometer-based seismic vibration monitoring systems.

### **Similarities between the High Temperature and the standard Velomitor®**

A basic advantage of the Velomitor® is the absence of connectors in the signal path until the signal has been pro-

cessed into a velocity signal. This eliminates the possibility of output noise generation due to connection problems in a vibration environment. This feature is used in the design of all Velomiters.

Both units provide a velocity signal for transmission from the machine to the monitor instead of the acceleration signal that is provided by most piezoelectric systems. A velocity signal is preferable to an acceleration signal when making seismic vibration measurements at rotor frequencies.

The velocity level of the rotor frequency seismic vibration is typically as high, or higher, than the velocity level of the seismic vibration at other frequencies. The acceleration level of the rotor frequency seismic vibration is typically lower than the seismic vibration at other frequencies.

The reason for this is the presence of high acceleration level, high frequency seismic vibration on many machines. The acceleration level of the rotor frequency seismic vibration is usually significantly lower than the acceleration level of these high frequency vibrations. Integration of an acceleration signal to velocity provides a reduction in amplitude that is directly proportional to frequency.

The connector is the same on both transducers, so the same interconnect cables can be used. A cable is now available to connect to terminal strips in weatherproof housings.

### **Monitors**

The High Temperature Velomitor® System is compatible with the 3300/55 Dual Velocity Monitor when the -05 transducer option is selected. It is also compatible with the 2201/03-02 and 2201/03-03 monitors.

### **Turbine tests**

Each gas turbine has its own unique casing vibration environment. Therefore, the High Temperature Velomitor System will be tested on each type of gas turbine before it is offered for general sale on that turbine.

For more information, contact your nearest Bently Nevada sales or service representative. ■